Personal Statement of Research for Mark S. Sherriff

While I would characterize research as my tertiary responsibility after teaching and service, I have maintained an active research program for a general faculty member. During my time at UVA, I have been awarded several NSF grants, published numerous papers at top CS education venues, have served as guest editor for the top CS education journal, started a research group for undergrads on gamification in CS education, and helped create the Center for Innovation in Computing Education and Outreach, now serving as its first director.

Empirical Research of Scholarship of Teaching and Learning in CS Education

My primary research focus over the past several years has been around how to improve the overall state of CS education research. A major problem that the CS education community faces is that the large majority of those doing research in CS education do so without the proper methods or analysis. Too often CS education research experiments and papers are done ad-hoc, without much thought of developing a solid research question or proper data collection. Depending on their domain research area, it is possible, if not likely, that a faculty member has never done research with human subjects in an educational setting, having to navigate things such as going through an institution's IRB. These studies tend to have limited applicability and repeatability, thus limiting the impact of the research.

While there is certainly a place in the field for experience and anecdotal reports, the CS education research community needs to move more deliberately into the field of scholarship of teaching and learning (SoTL). Working with my colleagues Dr. Jeff Carver at the University of Alabama and Dr. Sarah Heckman at North Carolina State University, we were awarded a 5-year, $1.4M collaborative grant to study the current state of empiricism in CS education research, and help address that need by creating workshops, tutorials, and resources to better education faculty interested in performing education research.

One of the primary areas of this work is the creation of the Designing Empirical Education Research Studies (DEERS) workshop. The first workshop was run in the summer of 2016 in Raleigh, NC, at NC State, with our team selecting twelve participants from a large group of applications. Our team followed this first cohort throughout the academic year, offering support and guidance, as they carried out their own research studies. Several of these projects turned into publications at the SIGCSE Symposium. The second workshop was held in 2017 at UVA, hosting another 18 participants, while also bringing back mentors from the previous cohort. The third DEERS workshop will also be at UVA and will take place in late July.

Using the material from the DEERS workshop, we have been able to have an even greater impact than originally thought. Every year we have offered a separate short workshop at the SIGCSE Symposium specifically on how to create a good research question. The workshop has filled with over 30 participants each year and continues to be well received. In June 2018, the Center for Teaching Excellence at UVA offered its first SoTL Scholars program workshop, which I helped run with Dr. Lindsey Wheeler. Even though this workshop was intended for any discipline of faculty at UVA, a large portion of the DEERS materials were used, and there is now a solid collaboration between the UVA CTE and the DEERS project going forward.

At the beginning of the project, our team performed a systematic literature review to determine the current state of empiricism in CS education research. We developed and iterated on an instrument that allows us to categorize the rigor of the empirical research methods used in a paper. We did not comment on or investigate the specific quality of the research undertaking itself, instead specifically focusing on the methods that were used and how the project was reported. Our initial findings were published at SIGCSE 2016 and our expanded investigation of multiple CS education venues is being compiled for a full journal article submission to ACM Transactions on Computing Education.

Center for Innovation in Computing Education and Outreach

One of my main goals over the past decade at UVA has been to move CS education research to the forefront. Few CS programs have CS education as a major research area and I have long felt that we at UVA are in a unique position to lead in this area. We have a large number of education-focused faculty who have been publishing at top venues on their own work. UVA CS faculty members are a recognized presence at the SIGCSE Symposium, with several faculty involved in the organizing and program committees and in other prominent positions. We have a large number of excellent students who are eager to learn more about the scholarship of teaching and learning as well.

This past year, I worked with Prof. Tom Horton to propose the Center for Innovation in Computing Education and Outreach. Our mission is to "[become] national leaders in computing educational research and practice that improves the experiences and outcomes of all students of computing at the university and beyond." I took on the role as the center's first director in January 2018. At this time, the steering committee has been formed with faculty from across Grounds, including individuals from several departments and the Curry School of Education. We plan to make our first major announcements in the fall of 2018, starting with a day-long

conference for CS faculty in the commonwealth of Virginia, including presentations on the state of CS education research from around the area.

Gamification in CS Education

   My passion for games and the power they can have in motivating individuals through any number of tasks led me to create the Game Design Research Group (GDRG) with Prof. Mark Floryan. Prof. Floryan and I are both instructors of the department's game design course and advisors for the Student Game Developers club. We wanted to create a group in which undergraduate students who were interested in game design and gamification as a research area could work together. GDRG has fluctuated in size from five to over twenty as we experimented with what the right makeup of students was.

   Toward the beginning of the group's inception, our primary focus was on gamification in the college classroom. The group created Gamer Card, a gamification portal that faculty and students could use to setup a course with gamification elements ranging from achievements to quests to experience points and associated rewards. The system was used and examined in multiple courses with the findings of the research being published at the ASEE Annual Conference in 2016. Our major finding was that the specific gamification elements did not have an appreciable effect on college students, but that any additional transparency in a student's standing in the course did. Thus, gamification techniques such as achievements and trophies did not significantly improve a student's motivation in a course, but experience points, which provide a direct and measurable way to determine how a student was doing, did have an effect. Follow on studies were performed, examining how to best present this supplemental gamification information to students.

   Later projects in the group focuses more on the role of virtual reality in education. Several studies examined the use of VR with elementary school children, using a VR simulation of walking around a civil war-era town to learn more about that period of history. Other studies examined music creation and performance in VR. All of these studies were done as senior thesis projects or distinguished major's projects for CS majors.

   The Game Design Research Group is now looking ahead to joining the Center for Innovation in Computing Education and Outreach.

Pedagogical Advances

   In my role as a teaching-track general faculty member, I have also conducted smaller published studies on my own pedagogical methods and advances. Many of these come from new courses that I have helped create. I worked with Prof. Aaron Bloomfield on the creation of the service learning practicum capstone course and our experiences were presented at the 2014 SIGCSE Symposium. Similarly, after I created the Mobile Application Development course here at UVA, I published my teaching methodology on the course at the 2010 IEEE/ASEE Frontiers in Education conference.

   Probably my largest contribution in pedagogy was the creation and publication of "Inform, Experience, Implement" as a teaching methodology for intense summer programming camps for younger students. Prof. Luther Tychonievich, Dr. Ryan Layer, and I refined our teaching method and curriculum over several years with the LEAD-CSI summer programming camps held at UVA. We created this methodology to aid other faculty creating summer camps who might not have as much experience with younger students. Our work was published at the 2010 IEEE/ASEE Frontiers in Education conference.

Summary

   Over the past decade, I have found ways to combine my passion for teaching with needs that I have seen in the community in CS education research. I believe that the DEERS project is having a definite, measurable impact on the state of empirical research in CS education and the scholarship of teaching and learning. The new Center for Innovation in Computing Education and Outreach will make UVA a major force in CS education research and pedagogy dissemination for years to come. My own personal research in gamification and teaching methods has been well received and accepted at numerous venues. I am proud of my research track record while at UVA and continue to work hard in the future.